THE USE OF WISC SCORES TO PREDICT READING IMPROVEMENT AFTER REMEDIAL TUTORING

By
ANITA B. DAHLKE

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CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

One of the most crucial concerns in the field of education and in our nation is that of widespread retardation in reading skills among elementary, secondary, and college students. Without these basic learning tools, many of them are handicapped in their acquisition of knowledge and are performing intellectually and scholastically far below their potential. This severe handicap not only plays an important role in students' school adjustment and mental health, but contributes greatly to the drop-out rate. The economic future and, perhaps, survival of our country depends on well-educated, productive citizens.

The incidence of reading retardation has been estimated by Marksheffel (1965) to be from 2,500,000 to 5,000,000 children so severely retarded in reading that they require immediate specialized help. Although estimates vary, it is probable that more than 10 per cent of the children of average intelligence in school are reading so inadequately that their total adjustment is impaired (Rabinovitch, 1959).

Reports from clinical sources reveal a disproportionate percentage of seriously retarded readers among boys as compared to girls. The range of percentages is

from approximately 65 per cent boys and 35 per cent girls to 90 per cent boys and 10 per cent girls (Heilman, 1967).

Results of numerous studies of the relationship of reading achievement and intelligence have led to the conclusion that intelligence is a major factor in reading success at all levels. Researches by Bond (1938), Bond and Fay (1950), Monroe (1932), and Strang (1943), show that this relationship becomes increasingly more pronounced as populations are sampled at succeedingly higher grade levels.

In a recent study by Fransella and Gerver (1965), expected reading ages for pupils were calculated from their chronological age (CA) and Wechsler Intelligence Scale for Children (WISC) Verbal IQ and it was found that the correlation of reading age with IQ increases with increase in CA.

Even though intelligence is related to successful achievement in reading, as it is to all other learning, this does not necessarily guarantee reading success for the child with a high IQ. From his studies, Betts (1956) concluded that eight out of ten retarded readers have normal or superior intelligence.

Kottmeyer (1959) states that it is not at all uncommon for bright pupils to develop reading disability, although most remedial readers will be of dull normal or normal IQ.

Since mental test performance is often considered

a good predictor of reading achievement, much research has been done in the area of identification of successful and unsuccessful readers, using the Wechsler Intelligence Scale for Children IQ scores and/or subtest patterns. The largely inconclusive results of many of these studies will be discussed in the next chapter.

The use of intelligence tests for prediction has been challenged by Harrington and Durrell (1955), since reading difficulties occur among children at virtually all intellectual levels. Consideration must also be given to the question of whether or not intelligence tests measure the important perceptual aspects of reading success and failure. In addition, IQ scores of retarded readers are often spuriously low when measured by a group intelligence test which requires reading.

Although research has been done in the area of early identification of children who are, or are likely to become, retarded readers, this identification process needs to be carried one step further to predict which retarded readers will have the greatest potential for growth. With the vast school enrollment and the shortage of trained reading personnel, it is an economic necessity to gear remedial instruction to the growth potential of the students.

Statement of the Problem

It was the purpose of this study to attempt to predict true reading gains made by retarded readers after

remedial tutoring, through the use of selected student variables.

Independent variables utilized included IQ and subtest scores obtained on the Wechsler Intelligence Scale for Children (Wechsler, 1949), pre-tutoring reading levels on the individually administered Diagnostic Reading Scales test (Spache, 1963a), age, sex, grade placement, and parental socio-economic status.

Definitions

The definition of a "retarded reader," as used in this study, was an individual who was retarded in a number of reading skills by one year or more, if in the primary grades, or by two years or more, if older (Spache, 1963b, p. 99).

"True reading gains" are distinct from observed gains made between pre- and post-tutoring reading test scores in that a multiple regression equation is used to overcome chance errors of measurement and spurious gains (Lord, 1963).

CHAPTER II

REVIEW OF RELATED LITERATURE

Research concerning various aspects of general intelligence and other factors thought to be related to reading ability will be reviewed in this chapter. These will include Wechsler Intelligence Scale for Children scale and subtest scores, age, grade, sex, and socio-economic status, as determined by the parental occupation classification on the Warner Revised Scale for Rating Occupations (Warner, 1960).

The Relationship of Reading to Selected Variables

WISC Verbal and Performance IQ's and Subtest Scores

An intelligence test such as the WISC is well suited for measuring verbal and performance abilities since it is individually administered and involves no reading.

The separation of the IQ into Verbal and Performance has proved helpful but some problems of interpretation have arisen. It is often assumed that for most persons, the Verbal IQ (V-IQ) and Performance IQ (P-IQ) will be equal. An analysis of the WISC standardization

data indicates that equal IQ's will be rare and that V-IQ will be greater than P-IQ about as often as P-IQ will be greater than V-IQ. About two-thirds of a group of random subjects will have V-P IQ differences smaller than the standard deviation of 12.5 points (Seashore, 1951).

Age bears no relation either to the direction or the size of the obtained discrepancies between V-IQ and P-IQ, the median of the differences being about eight points in the standardization sample (Wechsler, 1949).

There is no significant difference between the means and standard deviations of the V-IQ and P-IQ scores of rural and urban children so the stereotyped expectation that rural children are more "performance-minded" than "verbal-minded" is unwarranted (Wechsler, 1949).

Further evaluation of the standardization data indicates that children of parents with professional and semi-professional backgrounds have V-IQ's higher than P-IQ's but, except for this group, there is no significant tendency for children in diverse occupational groups to show relative excellence in either Verbal or Performance abilities (Seashore, 1951).

In a comparison of differences between Verbal and Performance IQ's of retarded and non-retarded readers, results of many studies indicate that retarded readers tend to have significantly higher Performance IQ's than Verbal IQ's and that non-retarded readers have Verbal IQ's significantly higher than those of retarded readers

(McLean, 1963; Coleman and Rasof, 1963; Neville, 1961; Feldt and Gunderson, 1960; Frommelt, 1964; Reid, 1963).

Research has not determined as yet whether inferior verbal abilities predispose children to reading failure or whether they compensate for failure in a verbal field by giving greater attention to self-development in the non-verbal area. Their poor performance in tests reflecting attention, concentration, and school-like learning may represent an actual inferiority or a negativistic response to academic pressures (Spache, 1963b).

Reid (1963) found no significant differences between mean IQ's of below-average and average reading groups on either the Verbal or Performance scales. No significant difference between Verbal and Performance scales was found in the studies made of severely retarded readers by Sandstedt (1964) and Kallos (1961).

Gunderson (1960) concludes from his study of verbal and non-verbal divergencies that high verbal intelligence leads to superiority in reading, language, and vocabulary; high non-verbal and low verbal intelligence lead to reading deficiency, especially if the IQ difference is 16 points or more.

Hage and Stroud (1959) state that verbal intelligence scores give a better prediction of academic achievement than do non-verbal scores at all levels of reading proficiency.

The Verbal scales of the WISC correlated higher

with the reading subtest of the California Achievement Test than did the Performance Scale in Barratt and Baumgarten's (1957) study of fourth and sixth graders.

Wilson (1967) states that the verbal score normally is considered the most valid predictor of performance in reading. With problem readers, however, it is the performance score that is most likely to provide the best measure of reading potential. The child's verbal score is likely to be limited by the same factors that limit his performance in reading. When WISC scores show P > V, there is just cause to encourage the child with development in reading.

Recent studies suggest that among older children the relationship of verbal to performance abilities may be more important for reading than level of intelligence. Belmont and Birch (1966) found that among older (CA 9-10) retarded readers of normal intelligence (WISC FSIQ $\geq$ 90) verbal abilities were lower than performance abilities, while a matched group of normal readers showed the opposite relation.

Using the WISC profile of the Belmont and Birch (1966) study, Reed (1967) selected all first and fifth graders of CA 6 and CA 10, respectively, in the schools of a large metropolitan suburb. At each age level, three groups were formed. At CA 6, Group I consisted of those children whose V-IQ was greater than P-IQ by ten or more points. At CA 10, the V-IQ was greater than the P-IQ

by 15 or more points. Group II at each age level included the children whose P-IQ exceeded the V-IQ by 15 or more points. Group III (V-P) contained the children whose V-IQ and P-IQ did not differ by more than two IQ points.

There were no significant differences in reading scores among the CA 6 groups. At CA 10, Group I differed significantly ($p < .01$) from the other two groups but there was no significant difference between Groups II and III.

Reed found that there was no evidence to suggest, at either CA 6 or CA 10, that the "retarded-reader intellectual pattern" could be used to identify children who become reading problems, nor could reading difficulty necessarily be attributed to a low verbal IQ.

Several analyses of WISC subtest score patterns are helpful in the identification of retarded and non-retarded readers.

Cohen's (1959) factorial analysis of the WISC yields five relatively separate factors:

Factor A--Verbal Comprehension I (Information, Arithmetic, Similarities)

Factor B--Perceptual Organization (Block Design and Object Assembly)

Factor C--Freedom from Distractibility (Digit Span)

Factor D--Verbal Comprehension II (Comprehension and Picture Completion)

Factor E--Quasi Specific (Coding and Picture Arrangement)

He feels that Factors A and D are interrelated but that the main difference seems to be the degree to

which they depend on the acquisition of formally learned material, Factor A through "school type" learning and Factor D through the application of incidental learning.

Cohen notes that retarded readers lack abilities in Factors A and C and do well on one subtest in Factors B and E.

It seems reasonable to conclude that retarded readers do poorest in subtests most nearly resembling school tasks and those requiring concentrated attention. Best performances do not show any logical pattern factorially but occur in those subtests clearly removed from verbal skills and in activities divorced from school tasks (Neville, 1961).

Several comparative studies indicate that retarded readers tend to score significantly low on Arithmetic, Coding, and Information (Neville, 1961; Spache, 1963b; Altus, 1956; Burks and Bruce, 1955; Sheldon and Garton, 1959; Robeck, 1964; Karlsen, 1955). Other studies indicate significantly high scores on Comprehension, Picture Arrangement, and Block Design (Neville, 1961; Coleman and Rasof, 1963; Burks and Bruce, 1955) and Picture Completion (McLean, 1963; Reid, 1963; Spache, 1963b; Robeck, 1964; Karlsen, 1955; Ekwall, 1966).

Ekwall (1966) found that the Coding subtest appeared to be more closely related to reading than other Performance tests. The retarded readers in his study were in the intermediate grades and scored significantly high on Coding, in contrast with most other studies reviewed.

In a recent study of extreme deviation of WISC subtest scores from Verbal and Performance scaled score means, Lerand (1966) found only Comprehension, Vocabulary and Coding significantly associated with reading level.

Kallos (1961) states that a low Coding score appears to be characteristic of a retarded reader, especially when Arithmetic or Information are low or Block Design is high.

Frommelt (1964) concluded from his study of successful and unsuccessful readers in the elementary school that only the Similarities and Coding subtests demonstrated a significant difference between the two groups, both being higher for the successful readers.

In an analysis of WISC scattergrams of 33 retarded readers, Pattera (1963) found subtests of Comprehension, Similarities, and Picture Completion to be significantly higher than the others, while Arithmetic and Vocabulary were significantly lower than Comprehension, Similarities, Picture Completion, and Coding.

Sawyer (1964, 1965) did a factor analysis of the WISC subtest scores of disabled readers at Syracuse University and feels that it is possible to distinguish between mildly disabled and severely disabled readers on the basis of these subtest scores. Probable group membership prediction, as determined by cross validity, was highly efficient.

When the group was classified by age, the ability

of the subtests to discriminate declined in effectiveness as chronological age increased. It also became apparent that contributions of the subtests to the discrimination varies with age. Picture Completion is increasingly associated with the severely disabled at the older age levels. With the increase in chronological age, Picture Arrangement shifts from contributing to membership in the mildly disabled group to membership in the severely disabled group. High scores in Coding, which seem to be characteristic of the severely disabled at the youngest age level, are more closely associated with the mildly disabled at the oldest age level. The reverse may be said about Digit Span.

Although Klebanoff et al. (1960), Parker (1957), and Wechsler (1949) maintain that there is diagnostic significance for certain subtests, Beck and Lam (1955) and Frank (1955) have gotten negative results with subtest pattern analyses.

In a factor analysis of the WISC, Lotsof et al. (1958) conclude that the verbal and performance aspects of this test are not independent of each other since these scales are not factorially pure.

Hopkins and Michael (1961) point out that there is very low reliability among the subtest scores, so very large differences must be evidenced before the hypothesis of chance variation can be rejected. They have compiled a reliability table showing the differences between scores which are necessary to be significant at both the .05 and .01 levels of significance.

Frommelt (1964) states that the use of WISC scaled scores of WISC scatter analyses should be limited to identification of reader groups, not to individuals, because of the overlap of subtest scores.

The study by Stroud et al. (1957) with children of dull normal IQ, in grades three to six, gave no support for the use of separate WISC verbal, non-verbal, and subtest score combinations in differential prediction of performance on reading comprehension, arithmetic, and spelling tests of the Iowa Tests of Basic Skills battery.

Rosner (1967) states that even though research suggests some characteristic WISC patterns for retarded readers, clinical experience with corrective readers tends to indicate that patterns vary considerably with the nature of an individual's needs.

Results of research give strong evidence of the relationship of intelligence to reading achievement but are largely inconclusive when attempting to identify typical WISC patterns for retarded readers.

Socio-Economic Status

Before reviewing the relationship of socio-economic status to reading achievement, it should prove helpful to consider its influence on WISC scores since they, in turn, relate to reading ability.

Estes (1951) administered the WISC to two groups of second and fifth grade children differing in socio-economic status (Warner Scale Values). Each group was

divided into upper- and lower-socio-economic levels. Significant differences in Full Scale IQ's in favor of the higher level were found in the total group of children and for those in second grade, but not for the fifth graders. In a follow-up study two years later, the former second graders were retested. The significant difference no longer existed. Estes felt that this lessening effect of socio-economic status reflected the increased "leveling" influence of the school with the passage of two years.

Levinson (1959) found no correlation between IQ level and socio-economic background for Jewish preschool children.

Two groups of 11-year-olds, differing in socio-economic status but matched for a number of other variables, were studied by Laird (1957). The mean WISC Full Scale score of the upper socio-economic group fell within the bright normal range, while the lower group mean fell within the average range. Greater differences were found between Verbal and Full Scale scores than between Performance scores.

In determining the relationship between socio-economic status and selected aspects of school achievement, Hill and Giammateo (1963) found significant differences between the mean scores of the high and low socio-economic status and subtest scores were positive and, in most instances, substantial.

Sheldon and Carrillo (1952) made a study of good

and poor readers and found that the good readers had fathers in professional or managerial positions 55 per cent of the time, while average or poor readers had fathers in these positions only 25-27 per cent of the time. In general, they concluded that good readers come most often from homes where fathers are employed in professional or managerial positions, average readers from homes of skilled and semi-skilled workers, and poor readers from homes where the father is employed in agriculture or holds a skilled or semi-skilled job.

In an analysis of reading achievement and social level in Berkeley, Wilson (1960) found that 90 per cent of the upper strata children were reading at grade level while only one-third of the children of semi-skilled or unskilled manual laborers were doing so.

Keshian (1961) chose a random sample of 406 successful fifth grade readers from low, middle, and high socio-economic levels. Results of a reading test led him to the conclusion that reading success and socio-economic status are not related.

Concurring in this opinion are Reid (1963), who studied fourth grade retarded readers from lower, middle, and upper classes (Warner Scale Values), and Dukes (1964), who found the mean reading scores of middle class groups higher than lower class groups, but not significantly higher.

Research in the area of relationship of reading achievement to socio-economic status is largely incon-

clusive. This is understandable, for the schools reflect the socio-economic level which they represent through their school facilities, curriculum, instructional materials, and teacher preparation. Realistic comparisons among socio-economic groups are difficult.

Sex Differences, Age, and Grade Level

Results of numerous studies indicate that girls are usually better readers than boys in the early grades. This is thought to be due to their earlier maturation and readiness for school-type activities. Girls are more tractable, more inclined to conform to classroom requirements, and more sensitive to parental and teacher disapproval. As a result, they probably try harder to learn.

A summary of research on remedial reading cases indicates that 60 to 80 per cent of the retarded reader population consists of boys (Smith, 1963).

Over six thousand children were tested by Alden et al. (1942) and the number of boys who were one or more years retarded in reading was double that of girls in each of the first five grades.

Stroud and Lindquist (1942) had the Every-Pupil Basic Skills Test administered to 50,000 pupils in grades three through eight and found that girls maintained a consistent and, on the whole, significant superiority over boys in the subjects tested, except in arithmetic. The largest differences occurred at grades three and four and declined significantly at grade six. In high school,

the advantage went to the boys, except in algebra and reading comprehension which favored girls, but not significantly so.

Another study, encompassing grades four through eight in an entire school system, was that of Sinks and Powell (1965), who concluded that no generality of the relationship of reading achievement to intelligence and sex could be made from their results, nor from a study of a similar sample.

Keshian (1961) found that the boys in his study of fifth grade successful readers were better readers than the girls. The median number of months by which reading age exceeded mental age was 11 for boys and only six for girls.

No sex differences in reading achievement were found among children of dull normal and average intelligence in the study done by Holowinsky (1961).

Fransella and Gerver (1965) calculated a predicted reading age from CA and the WISC V-IQ score and found that the correlation of reading age with IQ increases with increase in CA. The correlation of reading age with CA, however, decreases with increase in age.

Braun (1963) found that the coefficients between IQ (California Tests of Mental Maturity at grades three and five, Primary Mental Abilities at grade seven) and reading achievement (Gates Tests) decreased with advanced grade level.

The grade in school was one of four significant

predictors of reading improvement in a study done by Krippner (1963).

In general, research indicates that girls are better readers than boys in the primary grades but that this difference usually diminishes by the time they reach sixth grade.

Predicting Reading Gains

There is a dearth of research studies which have attempted to predict reading improvement of retarded readers after remedial tutoring, particularly those measuring either true or residual gains, rather than crude gains.

Rankin and Tracy (1965) discuss the advantages of residual gain over crude gain as measures of change. This technique was developed by Manning and DuBois (1958). Residual gain is the deviation of the observed post-test score from the post-test score that is predicted from the pre-test score. In effect, this technique permits the measurement of differences in improvement with subjects having been equated statistically on the pre-test. More specifically, residual gain represents the deviation of final scores from the regression line of final on initial scores.

No studies were found which used true gains as a measure of reading improvement, as does this study. This is a technique, described by Lord (1963), which is appropriate when a given individual actually is a member of some natural group under consideration, such as the

retarded readers in this study. Knowledge that an individual belongs to a certain group constitutes genuine information about that individual. Lord feels that an efficient method of estimation can and should make use of this information.

Essentially, this technique attempts to estimate the true change, $\underline{G}$, for each individual, as distinct from the observed change, $\underline{g}$. In order to do this, some estimate must be made as to how much of the observed change is simply chance fluctuation arising from errors of measurement. The true change can be predicted from observed values by means of an ordinary multiple regression equation.

The estimated value of the true change is:

$$\hat{G} = \overline{G} + b_{Gx.y}(x - \overline{x}) + b_{Gy.x}(y - \overline{y})$$

For a sufficiently large number of examinees,

$$\overline{G} = \overline{Y} - \overline{X}$$
$$= \overline{y} - \overline{x}$$

The following formulas are used for estimating the partial regression coefficients needed in the above equation for true gain.

$$b_{Gx.y} = \frac{(1 - r_{yy'})r_{xy}s_y/s_x - r_{xx'} + r^2_{xy}}{1 - r^2_{xy}}$$

$$b_{Gy.x} = \frac{r_{yy'} - r^2_{xy} - (1 - r_{xx'})s_x r_{xy}/s_y}{1 - r^2_{xy}}$$

The symbols, $r_{xx'}$ and $r_{yy'}$, represent the reliability coefficients of measurements x and y (pre- and post-test), respectively.

The consideration of true gain, as distinct from observed gain, overcomes the chance errors of measurement and spurious correlation existing between initial status on the pre-test and gain between pre- and post-test. Thus the "regression to the mean" phenomenon, observed with raw scores, does not occur.

It is important that teachers consider true gains, rather than crude gains, in appraising students' achievement because of the regression effect between pre- and post-test raw scores. It is possible that they have not been aware of this phenomenon because there is a very general tendency for good students to learn more than poor students, thus compensating for the regression effect that would otherwise appear.

In a study to determine factors significantly related to reading improvement after remedial instruction, Krippner (1963) collected data for 30 clinic cases. These included life age, degree of retardation, father's occupational level, part and whole WISC scores, Vineland Social Quotient, Peabody Picture Vocabulary Quotient, and total percentile on the Mental Health Analysis. After five weeks of tutoring, coefficients of correlation between each item of data and raw score reading gains were computed on the California Reading Test. Only four

of the variables were of statistical significance at the .05 level of significance. They were the Mental Health Analysis and the WISC Verbal IQ, the WISC Full Scale IQ, and the grade in school.

The relationship between reading improvement and performances on selected measures, including sociological, mental health, and intelligence, with particular reference to children who are emotionally disturbed or have low verbal intelligence, was studied by Krippner (1964). Subjects with a higher Performance than Verbal IQ on the WISC were taught, using kinesthetic techniques and materials. The only item of this study significantly correlated with reading gains was the Performance IQ on the WISC.

In a recent study by Bluestein (1966), raw score gains were calculated for 152 retarded readers. Of 28 variables considered, those found to be positively and significantly correlated included grade, achievement in reading and arithmetic, IQ, degree of disability, listening comprehension level, and age. The variables with negative but significant correlation were months of treatment, repeated grades, sex, emotional and social problems at end of treatment. Bluestein found that achievement in reading and arithmetic at time of placement appear to be the best predictors of improvement.

Scott (1963) found small positive correlations between intelligence and gains in reading made by students between the beginning of fifth grade and the end of the sixth grade.

A prediction equation was formulated by Sister Mary Peter Schlueter (1963) to predict reading gain by means of intelligence and personality tests. The 135 children receiving remedial instruction were in the fourth, fifth, and sixth grades. Tests used were the Lorge-Thorndike Non-Verbal Scale of Intelligence, the California Test of Personality, and the Gates Reading Survey Tests. Personality was found to be more predictive than intelligence and the combination of intelligence and personality was the best predictor in all areas (vocabulary, comprehension, and speed of reading).

Spache (1950) has suggested that measures of auding ability may mark a student's potential ceiling for reading ability. Potential reading level is measured by auditory comprehension in the Diagnostic Reading Scales and will be considered in this study.

Students whose auding scores exceeded reading scores appeared to profit more from remedial instruction than did students whose reading exceeded auding ability, states Brown (1954).

Moe (1957) found auding scores to be a useful measurement for predicting reading performance and they were even more effective when combined with a measure of mental age, since they are highly correlated. His findings applied to the first graders in his study.

The correlation of mental age and listening comprehension was also mentioned by Bliesmer (1954), who found

bright children superior to dull children of comparable mental age in this respect.

It is to be hoped that studies to predict true or residual reading gains will increase in number so that significant predictors of reading gains will be found.

CHAPTER III

DESIGN OF THE STUDY

The data needed to attain the purpose of this study were obtained from the files of retarded readers who had been referred to the University of Florida Reading Clinic for a diagnostic work-up and tutoring during the years 1954-1967.

Sample

Sixty-two white subjects, fifty-two boys and ten girls, were included in the sample. They ranged in age from six years, nine months, to 15 years, eight months, and were in grades one through eight. Any student having severe visual or auditory impairments was automatically excluded from the study, as were those classified as Borderline or Mentally Defective on the Wechsler Intelligence Scale for Children.

Each subject was tutored approximately 20-25 hours by an experienced tutor during the University of Florida summer reading clinic program or by a clinic staff member for an equivalent number of hours.

Instruments

The test used to measure intelligence was the Wechsler Intelligence Scale for Children (Wechsler, 1949).

It is an individual test of intelligence, for ages five to 15, which differs from other individual tests of intelligence in several ways. The first is its complete renunciation of the concept of mental age as a basic measure of intelligence since it is considered to be an absolute level of mental capacity, irrespective of the age of the child concerned.

Secondly, IQ's are obtained by comparing each subject's test performance not with a composite age group but exclusively with the scores earned by individuals in a single (that is, his or her own) age group.

Even more basic is the global concept of intelligence. The theory underlying the WISC is that intelligence cannot be separated from the rest of the personality and a deliberate attempt has been made to take into account the other factors which contribute to the total effective intelligence of the individual.

The WISC has two sub-groups--Verbal: Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Span; and Performance: Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding, Mazes. Ordinarily, five tests are administered to each subject, omitting Digit Span in the Verbal and Mazes in the Performance part (Wechsler, 1949).

Split-half reliability coefficients computed separately for the age samples of seven and one-half, ten and one-half, and 13 and one-half years are: Full Scale: .92, .95, .94; Verbal Scale: .88, .96, .96; Performance

Scale: .86, .89, .90 (Wechsler, 1949). All three scale scores appear to be sufficiently reliable for most testing purposes.

Correlations between WISC and Stanford-Binet range from the .60's to the .90's, varying with age, intellectual level, and heterogeneity of the samples.

Results of the individually administered Diagnostic Reading Scales (Spache, 1963a) were used as the pre- and post-tutoring reading achievement scores. Sufficient selections are available in the test booklet so that unfamiliar material was used on the post-tutoring test.

Grade placement scores are given on the following three levels: Instructional (Oral Reading); Independent (Silent Reading); and Potential (Auditory Comprehension).

> The term "Instructional Level" is used to designate the child's grade level in oral reading. It implies the level and quality of reading which most teachers would find acceptable in group or classroom practice, and the grade level of basal or other reading materials to which the child should or would be exposed in the typical classroom.
>
> "Independent Level" is that grade level of supplementary instructional and recreational reading materials which the pupil can read to himself with adequate comprehension, even though he may experience some word-recognition difficulties.
>
> The "Potential Level" indicates whether a child is capable of understanding materials of even greater difficulty than those he can read orally or silently. This might be considered the level to which his reading can grow under favorable conditions. Theoretically, a pupil can progress to his Potential Level when his difficulties with mechanics or vocabulary are overcome.
>
> (Spache, 1963a).

Reliability coefficients for the Instructional and Independent Level scores were computed by the test-

retest method at intervals varying from four to ten weeks and are .84 and .88, respectively.

Validity for the Instructional and Independent Levels was established by a comparison of the California Reading Test scores with Diagnostic Reading Scales scores obtained from pupils in grades two through six. These data present coefficients ranging from .63 to .92, with a median coefficient of .78.

Validity of the Potential Level scores in comparison to other measures of capacity was tested when 75 children were given the WISC and the Diagnostic Reading Scales. The correlation coefficient obtained was .80, suggesting a marked and consistent relationship between the two measures of potential (Spache, 1963a).

Dependent Variable

True reading gains at the Instructional Level were considered the dependent variable.

The true reading gain was calculated for each subject, based on his observed gain between pre- and post-tutoring Instructional Level scores on the Diagnostic Reading Scales. An ordinary multiple regression equation was used to overcome the chance errors of measurement and spurious correlation existing between initial status on the pre-test and gain between pre-test and post-test (Lord, 1963).

Independent Variables

Student characteristics considered in this study as possible predictors of true reading gain are:

Wechsler Intelligence Scale for Children:

Full Scale IQ (FS-IQ)
Verbal IQ (V-IQ)
Performance IQ (P-IQ)
Subtests: General Information (Info.)
General Comprehension (Comp.)
Arithmetic (Arith.)
Similarities (Sim.)
Vocabulary (Voc.)
Digit Span (D. S.)
Picture Completion (P. C.)
Picture Arrangement (P. A.)
Block Design (B. D.)
Object Assembly (O. A.)
Coding (Cod.)

Diagnostic Reading Scales:

Independent Level (Ind.)
Potential Level (Pot.)
Difference between Independent and Instructional Levels (Ind.-I)
Difference between Potential and Instructional Levels (Pot.-I)
Difference between Grade placement and Instructional Level (Gr.-I)

Other:

Age
Sex
Socio-Economic Status (Warner Scale Values)

Hypotheses

Hypothesis I: The distribution of subjects will fall equally into three groups:
V = P (within 12.5 points)
P > V
V > P

Hypothesis II: There will be no significant difference in true gain means in reading improvement among the three groups of V = P, P > V, and V > P.

Hypothesis III: There will be no significant difference in true gain means in reading improvement among the WISC Full Scale IQ classifications of the subjects.

120-129--Superior
110-119--Bright Normal
90-109--Average
80- 89--Dull Normal

Hypothesis IV: There will be no significant predictors of true reading gain from among the 22 student characteristics considered.

CHAPTER IV

ANALYSIS OF THE DATA

This study was designed to consider various characteristics of retarded readers as possible predictors of true reading gain after remedial tutoring. These student characteristics included the Wechsler Intelligence Scale for Children scale and subtest scores, age, grade, sex, socio-economic status, and pre-tutoring reading levels, as measured on the Diagnostic Reading Scales.

The Findings

Information regarding the student characteristics considered in this study, except for sex and socio-economic status, is presented in Table 1.

Verbal IQ and Performance IQ

Distribution of Subjects.--Due to the conflicting results of research investigating the V-IQ and P-IQ characteristics of retarded readers, it was hypothesized that the subjects in this study would be distributed equally among three groups: V = P (within 12.5 points); P > V; V > P.

The observed and expected frequency distribution of the subjects is shown in Table 2. The null hypothesis was tested by the Chi-square method.

TABLE 1

MEAN, RANGE, AND STANDARD DEVIATION OF VARIABLES

Variable	Mean	Range	Standard Deviation
Grade	4.7	1-8	1.89
Age	11.0	6-9-15-8	2.16
V-IQ	100	80-131	11.44
P-IQ	103	76-125	11.47
FS-IQ	102	81-121	10.67
Info.	10	4-19	2.75
Comp.	11	5-19	2.82
Arith.	9	4-17	2.67
Sim.	10	5-17	3.39
Voc.	8	5-16	4.58
D. S.	6	4-13	4.55
P. C.	11.5	5-17	2.97
P. A.	9	7-17	4.93
B. D.	10.5	5-17	2.62
O. A.	8.5	5-15	4.14
Cod.	8.5	5-17	3.12
Ind.	3.5	1.0-6.5	1.84
Pot.	5.8	2.8-8.5	1.53
Gr.-I.	2.4	.9-5.4	1.18
Pot.-I.	2.9	.7-5.2	1.10
Ind.-I.	.7	0-4.0	.82
True Gain	1.0	.3-2.4	.48

TABLE 2

OBSERVED FREQUENCY AND EXPECTED FREQUENCY IN THREE CATEGORIES ASSUMING A UNIFORM DISTRIBUTION IN THE POPULATION

	V = P	P > V	V > P	Sum
Observed f	40	16	6	62
Expected f	(20.66)	(20.66)	(20.66)	62

$X^2 = 18.1 + 1.1 + 10.4$

$= 29.6$

$p < .01$, 2 df $\quad X^2 = 9.210$

Since the value of the test statistic falls in the rejection region, the null hypothesis of equal distribution must be rejected.

The WISC standardization data show that two-thirds of the sample had Verbal and Performance IQ's within the range of one standard deviation of 12.5 points. This is also true in the present study. If the 40 subjects who are in the V = P category are disregarded and the distribution of the remaining subjects is tested for equal probability in the P > V and V > P categories, the null hypothesis must again be rejected, since the test statistic falls in the rejection region.

$X^2 = 11.5$

$p < .01$, 1 df $\quad X^2 = 6.635$

We can therefore assume that there is a significant difference in observed frequency between the two remaining categories, a significantly greater number being in the P > V group.

Group Differences in True Gain Means.--An analysis of variance was made on the true gain means of the three groups, V = P, P > V, and V > P, in order to determine whether or not there was a significant difference among them. The appropriate data are found in Table 3 and Table 4.

Since the F value does not exceed the critical value of $F_{.05} = 3.15$, we must retain the null hypothesis and conclude that there is no significant difference among the true gain means of the groups considered.

TABLE 3

SIZE, TRUE GAIN MEAN, AND STANDARD DEVIATION OF V-P GROUPS

Group	Size	Mean	Standard Deviation
V = P	40	1.1	.47
P > V	16	.9	.53
V > P	6	.8	.39

TABLE 4

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG V-P GROUPS

Source of Variation	SS	df	MS	F[x]
Between Groups	.46	2	.23	1.01
Within Groups	13.53	59	.23	
Total	13.99	61		

[x]No significant difference at .05 level.

Full Scale IQ Groups

Research tells us that retarded readers are found at all levels of intelligence. Therefore, it should be helpful to determine if there is a significant difference in reading gains made at the various levels.

In an attempt to do so, the subjects in this study were grouped according to the Wechsler Full-Scale classifications, as listed in Table 5. Results of an analysis

of variance to test the null hypothesis of equal true gain means among the groups are given in Table 6.

TABLE 5

SIZE, TRUE GAIN MEAN, AND STANDARD DEVIATION OF FS-IQ GROUPS

Groups	Size	Mean	Standard Deviation
Superior	3	1.2	.40
Bright Normal	16	.9	.37
Average	33	1.1	.53
Dull Normal	10	1.0	.48

TABLE 6

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG FS-IQ GROUPS

Source of Variation	SS	df	MS	F[x]
Between Groups	.49	3	.16	.7036
Within Groups	13.50	58	.23	
Total	13.99	61		

[x]No significant difference at .05 level.

The calculated F value is far less than the critical value of 2.77 at the .05 level of significance; therefore, the null hypothesis must be retained. It must be concluded that there is no significant difference in true

gain means among the four FS-IQ groups considered in this study.

Correlation Matrix of Student Characteristics

The null hypothesis that there would be no significant predictors of true reading gain was tested by research data computations made at the University of Florida Computer Center.

A stepwise regression program was selected because it would give the desired correlation matrix of student characteristics considered in this study (Table 7), and a multiple linear regression analysis and summary table (Table 11).

In examining Table 7, the correlation matrix, four independent variables are found to be positively and significantly correlated with true reading gain at the .01 level of significance. They are grade ($r = .75$), age ($r = .68$), Independent reading level ($r = .83$), and Potential reading level ($r = .66$). The difference between Independent and Instructional reading levels (Ind.-I) is significantly correlated with true reading gain at the .05 level of significance ($r = .26$).

The null hypothesis must, therefore, be rejected.

Further examination of the matrix indicates the high intercorrelation among these five variables and true gain. Table 8 shows these significant relationships.

The variables of grade and age can almost be considered synonymous ($r = .96$). Since the Instructional,

TABLE 7

CORRELATION MATRIX AMONG TWENTY-TWO STUDENT CHARACTERISTICS AND TRUE READING GAIN

	Gr.	Sex	Age	V-IQ	P-IQ	FS-IQ	Info.	Comp.	Arith.	Sim.	Voc.	D.S.	P.C.	P.A.	B.D.	O.A.	Cod.	Ind.	Pot.	GR-I	Pot-I	Ind-I	True Gain
Gr.	1.00	-.20	.96	-.16	-.11	-.17	-.30	-.00	-.01	0.13	-.15	.05	-.10	-.08	-.04	.02	-.15	.77	.73	.71	.10	.42	.75^{xx}
Sex		1.00	-.30	-.02	-.02	-.02	-.11	-.10	-.00	.10	.23	-.09	-.17	.11	-.12	-.27	.31	-.21	-.35	-.21	-.36	-.22	-.16
Age			1.00	-.17	-.09	-.16	-.27	.00	-.06	.09	-.20	.08	-.06	-.11	.04	.09	-.15	.74	.76	.71	.21	.46	.68^{xx}
V-IQ				1.00	.44	.87	.72	.65	.57	.58	.30	-.06	.24	.18	.36	-.07	.12	.04	.05	-.24	-.04	.03	-.05
P-IQ					1.00	.83	.44	.28	.14	.41	.11	-.14	.60	.40	.76	.17	.16	-.04	-.10	-.14	-.07	-.09	-.01
FS-IQ						1.00	.70	.56	.44	.58	.25	-.11	.48	.33	.65	.06	.16	-.00	-.09	-.23	-.06	-.04	-.04
Info.							1.00	.27	.35	.32	.10	-.02	.32	.27	.33	-.04	-.11	-.05	-.13	-.35	-.05	-.00	-.12
Comp.								1.00	.26	.34	.20	-.19	.27	.13	.16	-.03	.08	.05	-.01	.01	.04	.13	-.07
Arith.									1.00	.39	.15	-.07	.10	.06	.14	-.11	.12	.09	-.05	-.03	-.09	.14	.01
Sim.										1.00	.15	-.04	.28	.09	.35	-.00	-.14	.08	.13	.05	.05	-.03	.13
Voc.											1.00	-.00	-.01	.60	.10	.01	.04	-.02	-.13	-.21	-.11	-.05	-.07
D. S.												1.00	-.17	-.13	-.04	.25	.03	.15	.03	.03	-.00	.18	.03
P. C.													1.00	.18	.34	.01	-.09	-.04	-.02	-.06	.05	.00	-.06
P. A.														1.00	.28	-.10	-.10	.02	-.06	-.12	-.05	-.02	-.01
B. D.															1.00	.15	.01	-.03	.01	.04	.16	.00	-.10
O. A.																1.00	-.10	-.04	-.09	.11	-.03	.06	-.08
Cod.																	1.00	-.02	-.20	-.23	-.25	-.05	-.02
Ind.																		1.00	.73	.25	-.01	.71	.83^{xx}
Pot.																			1.00	.38	.56	.42	.66^{xx}
GR-I																				1.00	.38	.32	.10
Pot-I																					1.00	.21	-.24^{x}
Ind-I																						1.00	.26^{x}
True Gain																							1.00

^{xx}Significant at the .01 level.

^{x}Significant at the .05 level.

Independent, and Potential reading levels are measured in grade levels, many of the same factors as in grade and age play a significant role in their high intercorrelation.

TABLE 8

CORRELATION MATRIX OF FIVE SIGNIFICANT VARIABLES AND TRUE GAIN

	Grade	Age	Ind.	Pot.	Ind-I	True Gain
Grade	1.00	.96	.77	.73	.42	.75
Age		1.00	.74	.76	.46	.68
Ind.			1.00	.73	.71	.83
Pot.				1.00	.42	.66
Ind.-I					1.00	.26
True Gain						1.00

Age, Grade and Sex Differences.--The relationship of age and true reading gain is depicted in Figure 1.

With grade level having such a high correlation ($r = .75$) with true reading gain, it was of interest to compute true mean gains and to consider sex differences at each grade level. This has been done in Table 9.

Sex was not found to correlate significantly with true reading gains in the matrix. This may be partly due to the small number of girls in the sample. In order to determine whether or not there was a significant difference between the true reading gain means of boys (1.03) and

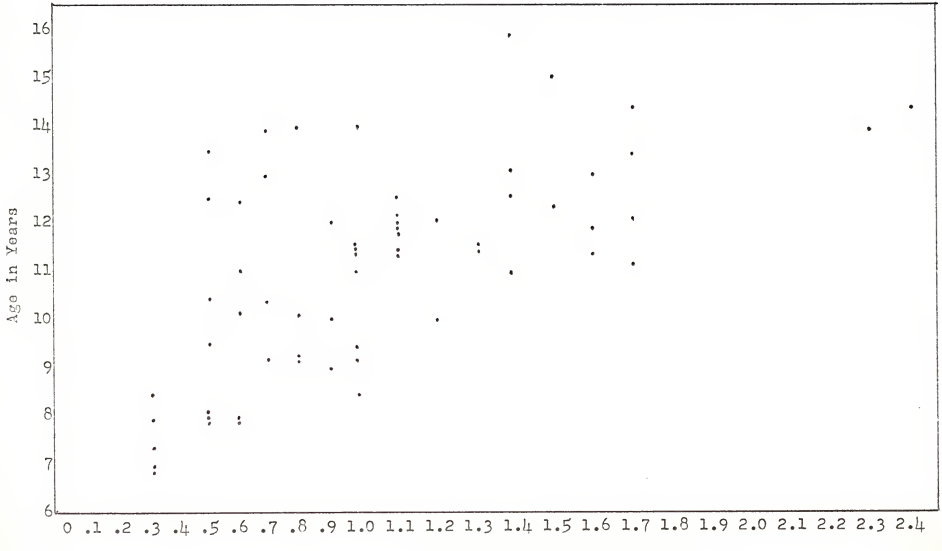

Figure 1.--Scattergram of True Reading Gain and Age

girls (.91), as given in Table 9, the Student's t-test was administered. No significant difference between means was found at the .05 level.

TABLE 9

FREQUENCY AND TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO GRADE LEVEL AND SEX

Grade	Number			True Reading Gain Means (year)		
	Boys	Girls	Total	Boys	Girls	Combined Scores
1	2	0	2	.3	--	.3
2	6	3	9	.5	.5	.5
3	5	3	8	.8	.9	.9
4	7	0	7	.8	--	.9
5	12	1	13	1.2	1.0	1.2
6	10	3	13	1.0	1.3	1.1
7	6	0	6	1.5	--	1.5
8	4	0	4	2.0	--	2.0
Total	52	10	62	1.03[x]	.91[x]	1.0

[x]No significant difference at .05 level.

Results of an analysis of variance of true gain among the eight grade levels are shown in Table 10.

It can be concluded that there is a significant difference at the .01 level of significance among true reading gains at the grade levels considered in this study.

TABLE 10

ANOVA TABLE FOR COMPARISON OF TRUE GAIN MEANS AMONG GRADE LEVELS

Source of Variation	SS	df	MS	F
Between Groups	9.19	7	1.31	14.56[x]
Within Groups	4.80	54	.09	
Total	13.99	61		

[x]Significant at .01 level.

WISC Scores.--Rather surprisingly, none of the WISC scale or subtest scores showed a significant correlation with true reading gain. In fact, all of them were either negatively correlated with true reading gain or had very small positive correlations.

Reading Levels.--As noted previously, the Independent reading level (silent reading) and the Potential level (auditory comprehension) are significantly correlated with true reading gain at the .01 level, with ($r = .83$) and ($r = .66$), respectively.

The difference between Independent and Instructional levels (Ind.-I.) is significantly correlated with true reading gain at the .05 level of significance.

Interestingly, the degree of retardation, measured by the difference between grade placement and Instructional level (Gr.-I), was not significantly correlated with true reading gain in this study, as it is often believed to be.

Summary Table of Stepwise Multiple Regression Analysis

In addition to the correlation matrix (Table 7) already discussed, the program selected computes a sequence of multiple linear regression equations in a stepwise manner. At each step, one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error sum of squares and which, if it were added, would have the highest F value.

TABLE 11

SUMMARY TABLE OF STEPWISE MULTIPLE REGRESSION ANALYSIS

Step Number	Variable Entered	Multiple r	Multiple r^2	Increase in r^2	F Value
1	Ind.	0.8258	0.6819	0.6819	128.6302[x]
2	Ind.-I.	0.9448	0.8926	0.2107	115.7195[x]
3	Pot.-I.	0.9501	0.9027	0.0102	6.0539[x]
4	Pot.	0.9884	0.9770	0.0743	184.3102[x]
5	P-IQ	0.9893	0.9788	0.0018	4.6860[x]
6	FS-IQ	0.9899	0.9800	0.0012	3.2768[x]
7	Sim.	0.9901	0.9803	0.0003	0.7878
8	P.C.	0.9902	0.9806	0.0003	0.7447
9	Voc.	0.9904	0.9808	0.0003	0.7599
10	P.A.	0.9906	0.9812	0.0004	1.0676
11	Age	0.9907	0.9815	0.0003	0.8757
12	Gr.-I.	0.9910	0.9821	0.0005	1.4809
13	Info.	0.9911	0.9823	0.0002	0.6432
14	Sex	0.9912	0.9825	0.0002	0.5347
15	B.D.	0.9913	0.9827	0.0002	0.4371
16	Arith.	0.9914	0.9828	0.0001	0.2582
17	Grade	0.9914	0.9829	0.0001	0.2279
18	D.S.	0.9914	0.9829	0.0001	0.1808
19	O.A.	0.9915	0.9830	0.0000	0.1044
20	Cod.	0.9915	0.9830	0.0000	0.0474
21	Comp.	0.9915	0.9830	0.0000	0.0317
22	V-IQ	0.9915	0.9830	0.0000	0.0033

[x]Significant at the .01 level of significance.

It is apparent from this summary table that the two most important factors accounting for variance in the true reading gain are the Independent reading level and the difference between Independent and Instructional levels (Ind.-I.), accounting for 68 per cent and 21 per cent, respectively. The Potential level contributes an additional 7 per cent to the variance. All three variables have F values significant at the .01 level.

Although the difference between Potential and Instructional levels (Pot.-I), P-IQ, and FS-IQ have significant F values at the .01 level also, it can be seen that their role in accounting for true gain variance is very minute, as is that of all remaining variables. Surprisingly, V-IQ contributes nothing at all to the true reading gain variance.

Using the two variables which contribute 89 per cent of the variance, Independent level and Independent-Instructional, it is possible to derive a predictive equation from the computer data which might be used to predict approximate true reading gains of retarded readers, after remedial tutoring. It must be noted, however, that this equation would be appropriate only for use with retarded readers as defined in this study, under similar tutoring conditions, with reading levels and true gain being determined from Diagnostic Reading Scales results.

True gainability prediction equation:

$$\hat{G} = .08 + .33 \text{ (Ind.)} - .38 \text{ (Ind.-I.)}$$

Results of this prediction equation for true gainability in reading have been found to be reasonably accurate when compared to the actual true reading gains of the subjects in this study. In most cases, the predicted and actual true reading gains vary within a range of one month.

Additional Findings

Socio-economic status, as determined by parental occupation classification on the Warner Revised Scale of Occupations (Warner, 1960), originally had been intended as an independent variable in this study. Unfortunately, files of eight of the subjects were incomplete and parental occupations were consequently unknown. It was difficult to assign reliable classifications in other cases because the self-described positions were often of vague nature. With incomplete data such as these, it was deemed advisable to leave it out of the matrix.

In order to investigate any differences in true gain means among the subjects from the various occupational groups, as classified, a frequency distribution table was compiled (Table 12) and an analysis of variance performed (Table 13).

It must, therefore, be concluded that there is no significant difference among true reading gain means of children of different socio-economic status considered in this study.

TABLE 12

FREQUENCY AND TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO PARENTAL OCCUPATIONS (WARNER SCALE)

	Prof.	Prop. & Mgrs.	Bus. Men	Clerks, Kindred	Man. Workers	Prot. & Serv.	Farmers	Unknown
Frequency	16	7	3	9	13	0	6	8
True Gain Mean	1.0	.9	1.0	1.3	.9	0	1.2	1.0

TABLE 13

ANOVA TABLE OF TRUE READING GAIN MEANS OF SUBJECTS GROUPED ACCORDING TO PARENTAL OCCUPATION (WARNER SCALE)

Source of Variation	SS	df	MS	F
Between Groups	1.14	6	.19	.81
Within Groups	12.85	55	.234	
Total	13.99	61		

[x]Not significant at the .05 level.

Summary

In summary, analysis of the data in this study has indicated:

1. Retarded readers are not distributed equally among V = P (within 12.5 points), P > V, and V > P groups.

2. There is no significant difference in true

gain means among the three groups of subjects in V = P, P > V, and V > P.

3. There is no significant difference in true gain means among the four groups of subjects classified by WISC FS-IQ as having superior, bright normal, average, or dull normal intelligence.

4. There are five significant predictors of true reading gain, including grade, age, Independent reading level, Potential reading level, and the difference between Independent and Instructional levels.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study was designed to consider various characteristics of retarded readers as possible predictors of true reading gain after remedial tutoring. These student characteristics included the Wechsler Intelligence Scale for Children scale and subtest scores, age, grade, sex, socio-economic status, and pre-tutoring reading levels, as measured on the Diagnostic Reading Scales.

The definition of a "retarded reader" as used in this study was an individual who was retarded in a number of reading skills by one year or more, if in the primary grades, or by two years or more, if older (Spache, 1963b).

"True reading gains" are distinct from observed crude score gains made between pre- and post-tutoring reading test scores, in that a multiple regression equation is used to overcome chance errors of measurement and spurious gains (Lord, 1963). In this study, true reading gains were calculated from pre- and post-tutoring Instructional level scores on the Diagnostic Reading Scales.

The data needed to attain the purposes of this study were obtained from the files of retarded readers who had been referred to the University of Florida Reading

Clinic for a diagnostic work-up and tutoring during the years 1954-1967.

Included in the sample were 62 white subjects, 52 boys and 10 girls. They ranged in age from six years, nine months, to 15 years, eight months, and were in grades one through eight. Any student having severe visual or auditory impairment was automatically excluded from the study, as were those classified as Borderline or Mentally Defective on the Wechsler Intelligence Scale for Children.

Each subject was tutored approximately 20-25 hours by an experienced tutor during the University of Florida summer reading clinic program or by a clinic staff member for an equivalent number of hours.

The Findings

It had been hypothesized that the subjects in the study would be distributed equally among the three groups of V = P (within 12.5 points), P > V and V > P. This hypothesis was tested by the Chi-square method and rejected because, as in the standardization sample, two-thirds of the subjects were in the V = P group. In considering the remaining 22 subjects, however, there were significantly more in the P > V group than in the V > P group. This agrees with the results of many studies which indicate that retarded readers tend to have significantly higher P-IQ's than V-IQ's (McLean, 1963; Coleman and Rasof, 1963; Neville, 1961; Feldt and Gunderson, 1960; Frommelt, 1964; Reid, 1963).

Consideration must be given to the fact, however, that the child's verbal score may be limited by the same factors which limit his reading performance (Wilson, 1967), and that he may be compensating for failure in a verbal field by giving greater attention to self-development in the non-verbal area (Spache, 1963b).

With only 16 and six subjects in the P > V and V > P groups, respectively, results of this study have contributed little to research conclusions in this area.

Secondly, it was hypothesized that there would be no significant difference in true gain means in reading improvement among the three groups of V = P, P > V, and V > P. An analysis of variance confirmed this hypothesis.

With only six subjects in the V > P group in this study, definite conclusions should not be drawn. The acceptance of the null hypothesis, however, does cast doubt upon the verbal/performance relationship of retarded readers. If it is true that Verbal IQ is a better predictor of reading achievement, as claimed by Hage and Stroud (1959) and Barratt and Baumgarten (1957), the V > P group should have improved more than the other two groups. On the other hand, Wilson (1967) feels that the Performance IQ is a better indicator of reading potential for retarded readers than the Verbal IQ. Therefore, the P > V group should have made the best gains of the three groups.

Results from this study and others (Lotsof et al., 1958; Hopkins and Michael, 1961; Stroud et al., 1957)

indicate that research in the area of V-IQ and P-IQ characteristics of retarded readers is largely inconclusive.

The third hypothesis, that there would be no significant difference in true gain means in reading improvement among the WISC FS-IQ groups of superior, bright normal, average, and dull normal, was retained, after an analysis of variance was performed.

It would appear from these results that as long as retarded readers are of dull normal intelligence, or above, their intelligence classification should not preclude nor restrict their reading improvement after tutoring.

The null hypothesis that there would be no significant predictors of true reading gain was rejected after results of a stepwise multiple regression analysis were determined.

Four independent variables were found to be significantly correlated with true reading gain at the .01 level of significance. They are grade ($r = .75$), age ($r = .68$), Independent reading level ($r = .83$), and Potential reading level ($r = .66$). The difference between Independent and Instructional reading levels (Ind.-I.) is significantly correlated with true reading gain at the .05 level of significance ($r = .26$).

All five of these variables have understandably high intercorrelations. Grade and age could be considered almost synonymous ($r = .96$) and the other three variables

are all measured by grade levels, thereby encompassing many of the same factors as found in grade and age.

The highly significant correlation of grade and age with true reading gain has important implications for education. Results of this study indicate that we should concentrate our clinical remedial reading efforts on children beyond the primary grades. Kottmeyer (1959) concurs in this opinion. In the primary grades, children are in the "learning to read" stage and are gradually building a sight vocabulary, learning word attack skills, and building concepts. Since most classwork is oral, their Independent level (silent reading) is often no higher than their Instructional level (oral reading). Therefore, reading readiness or beginning reading activities should be geared to their needs to strengthen any areas of weakness, rather than remediation. In the grades above primary level, the "reading to learn" stage of development, the emphasis changes from oral reading to silent reading. The student now needs to learn to read and to analyze words independently and, hopefully, strives to develop this skill. His experiential and conceptual backgrounds are widening, as are his sight and meaningful vocabularies. He is used to going to school and should have developed a longer span of attention than the primary child. Add to this the maturity to see the need for becoming a good reader in studying in the content areas and evidence mounts as to why he is a better candidate for remedial reading instruction than the very young child, should he encounter difficulty.

He may have some word recognition difficulties but is able to get enough clues for good comprehension.

Results of this study indicate that the difference between his Independent and Instructional reading levels is a significant predictor of reading gain to be made.

The Potential reading level, based on auditory comprehension, is also a significant predictor of true reading gain. It would be a reflection of a child's conceptual background and his meaningful vocabulary. If he can understand something through listening, he should be able to learn to recognize these same concepts in print more easily than material too difficult to understand. Spache (1950) has suggested that measures of auding ability may mark a student's potential for reading ability. Both Moe (1957) and Brown (1954) found auding scores to be good predictors of reading achievement, as did Bluestein (1966).

Sex differences played no significant role in predicting true reading gain in this study, perhaps due partly to the small number of girls in the study, nor did they in the studies by Bluestein (1966), Sinks and Powell (1965), or Holowinsky (1961).

None of the WISC scale or subtest scores showed a significant correlation with true reading gain in this study. All of them were either negatively correlated or had very small positive correlations. This is in contrast to Krippner's (1962) study in which both the WISC FS-IQ

and V-IQ were significantly correlated to reading gain. Bluestein (1966), too, found IQ to be significant in this study. Both of these studies used raw score gains in reading improvement and this may have resulted in the contradictory findings.

It may be that the relationship between IQ level and reading improvement has been unduly stressed. Belmont and Birch (1966) suggest that level of intelligence may be less important for reading than the relationship of Verbal to Performance abilities.

It seems reasonable to conclude from results of the present study that level of intelligence has little relationship with reading improvement, as long as the subjects have at least dull normal or higher intelligence and conditions of this study are met.

The analysis of variance of true gain means among subjects from differing socio-economic levels showed no significant difference. Concurring in this opinion are Keshian (1961), Reid (1963), and Dukes (1964). Quite the opposite results were obtained by Sheldon and Carrillo (1952), Wilson (1960), and Hill and Giammateo (1963). It must be remembered that schools reflect the socio-economic level which they represent. This includes the learning environment of school facilities, curriculum, materials, teacher preparation, and teacher effectiveness. Unless this environment were matched for subjects from different socio-economic groups, no realistic comparisons

could be made. Even then, the experiential backgrounds of the children would vary so widely that results would still be inconclusive.

Results of this study have contributed little to forming a conclusion in the area of socio-economic influence on reading improvement, for the parental occupations were unknown for one-eighth of the subjects and many others were vaguely described.

One of the most interesting findings in this study was the fact that the degree of reading retardation (Gr.-I.) had no significant correlation with true reading gain. Other studies, such as Bluestein's (1966) have found it a significant predictor of raw score reading gains. The phenomenon of regression to the mean on post-test scores has led many to believe that remediation efforts should be spent on those most retarded in reading since they apparently make the greatest gain after tutoring. Results of this study indicate that this is not true. The unique feature of this research is that true reading gains are used, rather than crude score gains. In the process of computing true gains, the multiple regression equation used overcomes chance errors of measurement and spurious correlations existing between initial status on the pre-test and gain between pre-test and post-test. Therefore, the apparent "regression to the mean" phenomenon never occurs and there is strong evidence that it is really just a statistical artifact.

Upon examination of the stepwise multiple regression analysis summary table, two variables are found to contribute 89 per cent of the variance. They are the Independent level (Ind.) and the difference between the Independent and Instructional levels (Ind.-I.).

Using these two variables, it is possible to derive a prediction equation from the computer data which might be used to predict approximate true reading gains made by retarded readers after remedial tutoring. It must be noted, however, that this equation would be appropriate only for use with retarded readers as defined in this study, under similar tutoring conditions, with reading levels and true gain being determined from Diagnostic Reading Scales results.

True gainability prediction equation:

$$\hat{G} = .08 + .33 \text{ (Ind.)} - .38 \text{ (Ind.-I.)}$$

Results of this prediction equation for true reading gain have been found to be reasonably accurate when compared to the actual true reading gains of the subjects in this study. In most cases, the predicted and actual true reading gains vary within a range of one month.

Implications for Education

Assuming that definitions and conditions are similar to those in this study, the following implications might be made:

1. The student who appears to make the best true gain in reading after remedial tutoring is the older one,

above primary grades, who has developed his Independent reading level well above his Instructional level and whose Potential level is also above his Instructional level.

2. True gains should be considered in measuring reading improvement, rather than crude gains, which may mistakenly lead one to believe that the most retarded readers make the best gains, due to the "regression to the mean" phenomenon. The use of a multiple regression equation in computing true gains overcomes chance errors of measurement and spurious correlation existing between initial status on the pre-test and gain between pre-test and post-test.

Implications for Research

1. More studies need to be done using true reading gains as the dependent variable, rather than crude score gains. This would help to clarify the role of "degree of retardation" as a predictor of reading improvement.

2. This study could be replicated using larger groups, matched as to number of boys and girls and/or as to V = P, P > V, V > P groups.

3. The true reading gainability prediction equation should be tested on other retarded readers.

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BIOGRAPHICAL SKETCH

Anita B. Dahlke was born in Fond du Lac, Wisconsin. In June, 1943, she graduated from Neshkoro Public High School. In February, 1949, she received the degree of Bachelor of Arts with a major in social work from the University of Wisconsin. Following graduation, she was a case aide worker for the Lutheran Children's Friend Society in Wauwatosa, Wisconsin. From 1950-1953, she was employed as an executive secretary at Oscar Mayer and Company in Madison, Wisconsin. After a period of self-employment, she attended Wisconsin State University-Oshkosh, from 1959-1960, obtaining a teaching certificate. She taught junior high school developmental reading in Wautoma, Wisconsin, in 1960-1961 and in Neenah, Wisconsin, from 1961-1963. She received the degree of Master of Education from the University of Florida in 1964, with a major in Counseling and Guidance and a specialization in reading. She became an Instructor at Wisconsin State University-Oshkosh in 1964, where she set up the university reading clinic and became its director. In January, 1966, she initiated doctoral studies at the University of Florida in Special Education-Learning Disabilities. She was employed as a graduate assistant in the Reading Clinic and later as an Instructor in the Elementary Education Depart-

ment, in which she taught clinical reading and reading methods courses. In September, 1968, she will return to Wisconsin State University-Oshkosh as Director of the Reading Clinic and member of the graduate faculty, with the rank of Assistant Professor.

She is a member of Kappa Delta Pi, Association for Childhood Education, Council for Exceptional Children, International Reading Association, Florida Association for Supervision and Curriculum Development and the John Dewey Society.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Education and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Education.

August, 1968

B. Sharp & M-C Baker
Dean, College of Education

Dean, Graduate School

Supervisory Committee:

George D. Spache
Chairman

Audrey S. Schumacher

Myron Lunington